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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/656,467	09/05/2003	Scott Bell	0180181	8443
25700	7590	05/12/2005	EXAMINER	
FARJAMI & FARJAMI LLP 26522 LA ALAMEDA AVENUE, SUITE 360 MISSION VIEJO, CA 92691			TRAN, BINH X	
			ART UNIT	PAPER NUMBER

1765

DATE MAILED: 05/12/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/656,467

Applicant(s)

BELL ET AL.

Examiner

Binh X. Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 05 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,4-9,11-16 and 18-20 is/are rejected.
- 7) ☒ Claim(s) 3,10 and 17 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 12/01/2003.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date: \_\_\_\_\_.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Double Patenting***

1. Claim 10 is objected to under 37 CFR 1.75 as being a substantial duplicate of claim 3. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

2. Applicant is advised that should claims 1-2, 4-5, 7 be found allowable, claims 8-9, 11-13 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claim 6 is rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. The step of forming a hard mask layer is critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). In

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claim 6, applicants further disclose "the step of etching a hard mask layer". However, applicants fail to disclose how to form a hard mask layer. It is impossible to "etch" the hard mask layer, without forming a hard mask layer previously.

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1-2, 4, 6-9, 11, 13 are rejected under 35 U.S.C. 102(e) as being anticipated by Liu et al. (US 2004/0043623 A1).

Respect to claims 1 and 8, Liu discloses a method for reducing resist height corrosion in a gate etch process, comprising the steps of:

forming a first resist mask (212) on an anti-reflective coating layer (208) situated over a substrate (200), said first resist mask (212) having a first width (207) (Fig 2C, paragraph 0025-0026);

trimming the first resist mask to form a second resist mask, the second resist mask having a second width (211), the second width being less than the first width (207) (See Fig 2D, paragraph 0027);

performing an HBr plasma treatment on the second resist mask (paragraph 0031-0033).

Liu does not explicitly disclose that the HBr plasma treatment causes a vertical etch rate of the second resist mask to decrease. However, Liu teaches identical process step using identical material with the present invention. Thus, result of the HBr plasma treatment process would inherently cause a vertical etch rate of the second resist mask to decrease.

Respect to claims 2, 4, 9 and 11, Liu discloses the step of trimming the first resist mask comprises etching the antireflective coating layer (208) (Fig 2D-2E). Respect to claim 6, Liu discloses the step of etching the hard mask layer (226) (Fig 2D-2E). Respect to claims 7 and 13, Liu discloses the anti-reflective layer (208) comprises an inorganic layer (paragraph 0025).

7. Claims 1-2, 4-5, 6-9, 11-12, 13 are rejected under 35 U.S.C. 102(e) as being anticipated by Nallan et al. (US 2004/005817 A1).

Respect to claims 1 and 8, Nallan discloses a method for reducing resist height corrosion in a gate etch process, comprising the steps of:

forming a first resist mask (212) on an anti-reflective coating layer (209) situated over a substrate (200), said first resist mask (212) having a first width (223) (Fig 2D, paragraph 0023-0024);

trimming the first resist mask to form a second resist mask, the second resist mask having a second width, the second width being less than the first width (223) (See Fig 2E, paragraph 0025);

performing an HBr plasma treatment on the second resist mask (paragraph 0029-0031).

Nallan does not explicitly disclose that the HBr plasma treatment causes a vertical etch rate of the second resist mask to decrease. However, Nallan teaches identical process step using identical material with the present invention. Thus, result of the HBr plasma treatment process would inherently cause a vertical etch rate of the second resist mask to decrease.

Respect to claims 2, 4, 9 and 11, Nallan discloses the step of trimming the first resist mask comprises etching the antireflective coating layer (209) (Fig 2E-2F).

Respect to claims 5 and 12, Nallan discloses the anti-reflective layer (209) comprises an organic layer (paragraph 0023). Respect to claim 6, Nallan discloses the step of etching the hard mask layer (214) (paragraph 0031). Respect to claims 7 and 13, Nallan discloses the anti-reflective layer (209) comprises an inorganic layer (paragraph 0023).

### ***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

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not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claims 14-16, 18, 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu in view of Taylor et al. (US 2004/0079727 A1).

Respect to claim 14, Liu fails to disclose the step of HBr plasma treatment of the first resist mask before the trimming step. However, Liu clearly discloses the photoresist trimming step and the HBr plasma treatment after the trimming step. In a semiconductor process, Taylor discloses the step of HBr plasma treatment (i.e. HBr plasma curing) before or after the trimming step in order to strengthen the photoresist material (paragraphs 0031, 0023). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Liu in view of Taylor by performing a HBr plasma treatment before the trimming step because this will help to strengthen the photoresist material and resulting in well defined etched feature.

Taylor does not explicitly disclose that the HBr plasma treatment causes a vertical etch rate of the first resist mask to decrease. However, Taylor clearly discloses the HBr plasma treatment will strengthen the resist material and reducing the collapse and the twisting of the resist material (paragraph 0023, 0034). When the material is cured and strengthen (HBr plasma treatment), the etch rate of that material will be reduced, including the vertical direction.

Respect to claims 15 and 18, Liu discloses the step of trimming the first resist mask comprises etching the antireflective coating layer (208) (Fig 2D-2E). Respect to

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claim 16, Liu disclose the second width is about 40-80 nm.(paragraph 0027, with applicant's range of 25-50 nm). Respect to claim 20, Liu discloses the anti-reflective layer (208) comprises an inorganic layer (paragraph 0025).

11. Claims 14-15, 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nallan in view of Taylor et al. (US 2004/0079727 A1).

Respect to claim 14, Nallan fails to disclose the step of HBr plasma treatment of the first resist mask before the trimming step. However, Nallan clearly discloses the photoresist trimming step and the HBr plasma treatment after the trimming step. In a semiconductor process, Taylor discloses the step of HBr plasma treatment (i.e. HBr plasma curing) before or after the trimming step in order to strengthen the photoresist material (paragraphs 0031, 0023). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Nallan in view of Taylor by performing a HBr plasma treatment before the trimming step because this will help to strength the photoresist material and resulting in well defined etched feature.

Taylor does not explicitly disclose that the HBr plasma treatment causes a vertical etch rate of the first resist mask to decrease. However, Taylor clearly discloses the HBr plasma treatment will strengthen the resist material and reducing the collapse and the twisting of the resist material (paragraph 0023, 0034). When the material is cured and strengthen (HBr plasma treatment), the etch rate of that material will be reduced, including the vertical direction.

Respect to claims 15 and 18, Nallan discloses the step of trimming the first resist mask comprises etching the antireflective coating layer (209) (Fig 2E-2F). Respect to



claim 19, Nallan discloses the anti-reflective layer (209) comprises an organic layer (paragraph 0023). Respect to claim 20, Nallan discloses the anti-reflective layer (209) comprises an inorganic layer (paragraph 0023).

### ***Allowable Subject Matter***

12. Claims 3 and 17 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

13. The following is a statement of reasons for the indication of allowable subject matter: The cited prior art fails to disclose either one of the following limitations in conjunction with all other limitations in the claims: the HBr plasma treatment causes the vertical etch rate of the second resist mask to decrease by between approximately 40 percent and 80 percent; or the HBr plasma treatment causes an increase in lateral etch rate of the first resist mask.

### ***Conclusion***

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

*Binh Tran*

Binh X. Tran